FALL-SOWN GRAINS IN MARYLAND AND VIRGINIA

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FOR THE BEST RESULTS, fall-sown grains in Maryland, Delaware, and the Virginias require—

A well-drained, fertile soil, well supplied with humus and lime.

An abundance of available plant food, supplied by the use of stable manure, green crops turned under, and commercial fertilizers.

A rotation which includes at least one cultivated crop and one or more legumes.

A seed bed with the surface 2 or 3 inches loose and finely pulverized, while the soil just beneath is firm and moist.

Good, pure, cleaned, and graded seed which has been treated for smut, sown with a drill at the proper time and rate.

Varieties which are adapted to the locality and which produce high yields of grain of good quality. The best varieties are listed on page 23.

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CONTENTS

INTRODUCTION.

Methods and practices relative to the growing of fall-sown grains in Maryland and Virginia are discussed in this bulletin. While the statements made are based largely on experiments conducted in these two States, they are applicable over a somewhat wider area. The four States to which they particularly apply are Delaware, Maryland, Virginia, and West Virginia, constituting the northern portion of the South Atlantic group of States. Recommendations are also made as to the best varieties of the various grains to grow.

With the exception of wheat, the small grains are not important crops in these States. The average acreages of wheat, oats, barley, and rye in each State for the five years from 1911 to 1915, inclusive, with the acreage of corn for the same period for comparison, are shown in Table I.

TABLE I.—*Average acreage of corn, wheat, oats, barley, and rye in Delaware, Maryland, Virginia, and West Virginia for the five years, 1911 to 1915, inclusive.*

State.	Corn.	Wheat.	Oats.	Barley.	Rye.
Delaware	198,800	115,200	4,000	.....	1,000
Maryland	676,600	612,800	44,800	4,600	26,200
Virginia	1,997,200	856,800	196,000	10,800	56,400
West Virginia	739,200	248,400	112,200	.....	16,800

As shown by Table I, wheat is an important crop in each of the four States, though in every case the acreage is smaller than that of corn. The average wheat acreage in Delaware for the five years

from 1911 to 1915, inclusive, is about one-sixth (16.1 per cent) of the improved farm land in the State as recorded in the census of 1910. In Marland it is 18.3 per cent of the acreage of improved farm land, being only slightly smaller than the corn acreage. In Virginia only about 1 acre of improved land in 12 is sown to wheat, the percentage being 8.7, while in West Virginia only 4.5 per cent of the improved farm land is devoted to this crop.

None of the other grain crops occupies more than 2 per cent of the improved farm land in these States, oats just reaching that figure in Virginia and West Virginia. Rye does not occupy 1 per cent of the improved acreage in any of the four States. It is of greatest importance in Maryland (0.8 per cent) and Virginia (0.6 per cent). These figures represent the acreage harvested for grain. The acreage of rye sown is no doubt considerably greater, as many acres are plowed under for green manure each year.

GENERAL PHYSICAL CONDITIONS.

The three great natural divisions of the South Atlantic States are the Appalachian Mountains on the west, the Atlantic Coastal Plain on the east, and the Piedmont Plateau between. The elevation in these States varies from sea level to more than 3,000 feet. Climatic and soil conditions in the three sections are also markedly different. As a result, varieties and methods of culture of the different grain crops well adapted to one section are not always the best for another.

Rainfall in this section of the United States is usually ample for crop needs without special methods of moisture conservation such as are commonly practiced in regions of limited rainfall. Destructive winds and hailstorms very rarely occur, and comparatively mild winters usually prevail. In the vicinity of Washington, D. C., the lowest winter temperature usually ranges from zero to 10° F., falling as low as zero only about once in three years. In the higher western portions of Maryland and Virginia and in West Virginia the winters are much colder, zero temperatures occurring nearly every year. Only the hardier fall-sown grains, winter wheat and rye, survive there with certainty, though winter oats and winter barley can be grown successfully in favorable locations if sown early.

SOILS.

Many different types of soil are to be found in the South Atlantic States, varying from the lightest sands to the heaviest clays.

Loam soils are the most suitable for the production of grain; hence the clay loams of the Piedmont section and the sandy loams in the higher portions of the Coastal Plain are well adapted to this purpose. The heavier clay and silt loams in the valleys west of the Blue Ridge, especially those of limestone origin, are among the

best wheat soils in the United States. The best example of this type is the Hagerstown loam, a silt loam overlying a clay subsoil.

The typical soils of the Coastal Plain area are lighter and more sandy, including such well-known types as the Leonardtown loam and the Sassafras sandy loam. These soils when well supplied with lime and vegetable matter in connection with proper fertilization and a good system of crop rotation will produce profitable crops of winter wheat and other fall-sown grains. Winter oats are well adapted to these more sandy soil types and should be more generally grown than they are at present.

Fall-sown grains require a well-drained soil. In those sections in which the land is not naturally well drained, tile or other drainage should be supplied, as thorough surface and subsoil drainage is one of the first essentials for the production of profitable yields. Poor soil drainage is more often the cause of winterkilling and consequent failure of winter grain crops than any other soil condition.

FERTILIZERS.

Practically all the soils of the eastern United States which have been tilled for many years are deficient in the more important elements of plant food. Phosphorus, nitrogen, and in some localities potassium (potash) must be supplied in order to obtain satisfactory yields of grains and other field crops. These are in addition to liberal supplies of lime and humus, or decayed organic matter.

In those sections where the soil is in a good state of fertility, because a good system of crop rotation has been followed or because live stock has been included in the scheme of farming, phosphorus is usually the element that is most needed. It may be supplied by the addition of some form of phosphatic fertilizer, such as acid phosphate, ground rock phosphate (floats), steamed bone meal, or basic slag. Rock phosphate should be used only in combination with stable manure or green manure.

The principal sources of nitrogen are manure, the nitrate fertilizers, and the air. Of the nitrate fertilizers the most common are nitrate of soda, ammonium sulphate, cottonseed meal, tankage, and dried blood. The greatest and cheapest source of nitrogen is the air, for by growing such leguminous crops as clovers, cowpeas, soy beans, and vetch in rotation or as catch crops, nitrogen from the air is added to the soil much more economically than by the use of mineral fertilizers.

Soil analysis shows that most soils contain sufficient quantities of potassium (potash), but often it is not in a form available to plants. This condition usually can be corrected by the generous use of barnyard manure or green manure. The decay of this material in the soil ordinarily makes sufficient quantities of potash available for

crop needs. Where barnyard manure is not produced in sufficient quantities, or the plowing under of green manure is not practicable, potassium must be supplied in the form of commercial fertilizers. Those most commonly used are sulphate of potash, muriate of potash, and kainit.

Calcium or lime is supplied in either the burnt (calcium oxid), the slaked (calcium hydroxid, or hydrated lime), or the raw form (calcium carbonate), to improve the physical and chemical condition of the soil. Its chief function is to correct soil acidity, to "sweeten the soil," making it more suitable for the various soil organisms which aid plant growth. Only a small percentage of lime is actually taken up by cereal plants. Humus, or decayed organic matter, is supplied in barnyard manure or green manure and in crop residues (stubble, second growth, weeds, etc.).

The best results with small grains are usually obtained if the barnyard manure is applied to a preceding cultivated crop, such as corn or potatoes. When applied to the grain crop directly, the excess of nitrogen in the manure is likely to produce a heavy growth of straw, which may lodge. If the manure is applied to the small-grain crop it should be supplemented by 200 to 250 pounds of acid phosphate or rock phosphate (floats). This is also good practice when a heavy growth of cowpeas or other green crop is plowed under immediately preceding the grain crop.

A complete fertilizer usually gives the best results on thin soils, especially where little or no barnyard manure or green manure is available. If wheat follows oats or some other small-grain crop on land of fair to medium fertility, it will usually pay to use some nitrogen and potassium in the fertilizer. A 3–10–3 fertilizer—that is, one which contains 3 pounds of nitrogen for each 10 pounds of phosphorus and 3 of potassium—gives a very good proportion if a sufficient quantity is applied. On the worn soils of southern Maryland and east of the Blue Ridge in Virginia from 350 to 450 pounds of this fertilizer to the acre should give fair results. On the more fertile soils, especially those lying immediately to the west of the Blue Ridge in Maryland and Virginia, 150 to 250 pounds to the acre are sufficient.

If additional nitrogen is used, it should be applied as a top-dressing at about the time growth starts in the spring. For the spring application 75 to 125 pounds of nitrate of soda to the acre are most commonly used. Experiments conducted by several of the experiment stations in the eastern United States indicate that top-dressing the small grains is usually profitable only when the crop is in a backward condition, as the result of poor land, late seeding, abnormal weather conditions, etc. If the crop is well supplied with plant food, the use of nitrate of soda in this manner is of doubtful value. No

nitrogen is needed if leguminous green-manure crops, such as crimson clover or vetch, are grown in the rotation.

Half a ton to a ton of burnt lime or from 1 to 2 tons of ground or crushed limestone to the acre is a sufficient quantity to apply to most soils needing lime in the section under discussion. Heavier applications may be made, but it is usually considered better practice to make frequent light applications. There is then less loss through seepage and leaching. Two tons of ground limestone every four years is usually a satisfactory rate.

ROTATIONS.

In those sections of the South Atlantic States in which general farming is practiced one or more of the fall-sown grain crops usually occupy an important place in the rotation. In addition to their value as grain crops they serve as nurse crops for clover and grass, as winter cover crops, and frequently as winter pasture crops.

The continuous cropping of land to wheat or any other small-grain crop results in reduced yields and a depleted soil. A rotation of grain crops is not advisable, as it is little better than continuous cropping. By using large quantities of chemical (commercial) fertilizers it is possible to grow grain crops continuously on the same land for a long period of years, but the cost of the fertilizers makes such a practice unprofitable.

A good rotation should include a cultivated crop as well as a legume. The frequent stirring of the soil renders it loose and friable, improving its physical and chemical condition and making it more congenial to plant growth. In addition to this beneficial effect, the cultivation of row crops tends to destroy weeds and aids in keeping the land free from these pests.

The legumes not only gather nitrogen from the atmosphere and store it in the soil in a form available to succeeding crops, but also aid in maintaining the supply of humus. The clovers, cowpeas, and soy beans are the principal legume crops included in rotations with winter grains.

As a rule, local conditions determine the particular crops to be grown and their order in the rotation. For the greater portion of the Piedmont area and for many of the broad valleys west of the Blue Ridge a 4-year rotation of corn, wheat, and two years of clover and timothy or a 5-year rotation of corn, wheat two years, and clover and timothy two years, is the most practicable. By growing wheat twice in succession, as indicated in the second of these rotations, better conditions can be obtained for sowing to grass and clover. Meadows which result from "sowing down" with wheat on disked corn-stubble land are often rough and uneven, making the use of modern haying machinery more or less difficult. The timothy should

be sown with the wheat in the fall and the clover sown early in the following spring. In some districts of the lower Piedmont section fall-sown oats or barley may be added to the rotation with profit.

For Delaware, eastern and southern Maryland, and practically all of the upper Coastal Plain section of Virginia, similar rotations are adapted. Here crimson clover, cowpeas, and soy beans grow well, and one or more of these crops should be included in the rotation either for hay or for green manure. A 5-year rotation of corn, corn, wheat, winter oats, and clover is practicable. In this rotation crimson clover should be sown in the first crop of corn at the last cultivation and plowed under the following spring for the second crop of corn. It is also possible to grow a crop of cowpeas or soy beans for hay or green manure between the two small-grain crops.

A rotation that should be well adapted to these sections is as follows: (1) Corn, followed by rye, vetch, crimson clover, or rye and vetch, to be cut for hay or plowed under the following spring for green manure; (2) cowpeas or soy beans for hay; (3) wheat or fall-sown oats; (4) clover. This rotation provides for a cover crop each year, a crop that may be removed from the land each year, one green-manure crop, and two legumes. By supplementing these soil-improvement crops with generous applications of raw or rock phosphate in connection with the proper use of lime and the manure that is available on the average farm, such a rotation system should prove practicable, while at the same time it will maintain and gradually increase the fertility of the soil. This rotation is suitable also for some of the lower districts of the Piedmont area, particularly those in which straight grain farming has been generally practiced.

Other rotations, including one or more of such crops as potatoes, tobacco, rye, alfalfa, etc., in addition to any of the crops already mentioned, may be devised along similar lines.

PREPARATION OF THE SEED BED.

The ideal seed bed for fall-sown grains is one in which the surface soil to a depth of 2 or 3 inches is loose and finely pulverized, while the subsoil is firm and moist. To obtain these conditions the land should be plowed to a depth of 6 to 8 inches as early in the season as possible. For the best results the harrow should follow the plow immediately. Harrowing should be repeated frequently to kill weeds, to aerate the soil, and to settle the seed bed, especially the lower portion of the furrow slice. Late plowing does not allow the soil to become sufficiently compact for the best results.

In those sections in which the winter grain crop follows corn, the best seed bed usually can be prepared by disking and harrowing rather than by plowing. If weeds are numerous, plowing may be desirable. As plowing must be delayed, however, till the corn is

mature, there is usually not sufficient time for the seed bed to become well settled before sowing. For this reason, the land should not be plowed unless the weeds are so large and numerous that the disk harrow can not be used effectively.

When a heavy growth of cowpeas or other green-manure crop is plowed under, preceding winter grains, the plowing should be done at least two or three weeks before seeding time, in order to allow the vegetable matter plowed under to begin to decay and to become mixed with the soil. When these crops have been removed for hay a good seed bed usually can be prepared by disking and harrowing.

A well-prepared seed bed always greatly increases the chances of success in growing fall-sown grains. The importance of a good seed bed can not be too strongly emphasized. Thorough tillage in its preparation helps in offsetting the effects of drought and other unfavorable conditions.

THE SEED.

Experiments show that home-grown seed gives better returns than that brought from a distance. Changing seed is not to be encouraged if the variety grown is pure and is adapted to the locality.

All seed grain should be fanned and graded to remove weed seeds, chaff, straw, smut balls, and small or broken grains. This can be done with an ordinary fanning mill if it is properly adjusted.

Stinking smut of wheat, smut of oats, and covered smut of barley can be controlled by the formaldehyde treatment. Commercial formaldehyde (about 37 to 40 per cent pure formaldehyde) may be obtained at almost any drug store. To apply this treatment, mix the formaldehyde with water at the rate of 1 pound (slightly less than a pint) to 40 gallons of water. Spread the grain on a clean floor or canvas and sprinkle with the solution, shoveling the pile over during the process so that the surface of every grain is thoroughly wet. About a gallon of the solution will be needed for each bushel of dry grain. Immediately after sprinkling, shovel the grain into a pile, cover it with sacks wet with the solution, and allow it to stand for at least two hours before spreading it out to dry.

Instead of sprinkling the grain, it may be inclosed loosely in bags and immersed in a tub of the solution, or the loose grain may be put directly into it. The grain should be left in the solution only long enough to make sure that all of it has been wet. When loose grain is put into the solution the effectiveness of the treatment is increased by skimming off the smut balls that come to the surface.

The treated grain may be sown as soon as it is sufficiently dry to run through the drill. If the seed is still moist, however, the drill must be set to sow a greater quantity to the acre than if it is dry. The treated seed should not be allowed to come in contact with bags,

bins, or machinery in which there may be smut spores. To avoid this danger, drills, bags, etc., should be washed with the formaldehyde solution before putting the treated grain into them.

For the loose smut of wheat and barley, the hot-water treatment is the only effective preventive yet known. This treatment must be used with great care or the germination of the seed will be destroyed. For particulars regarding it and also for fuller details of the formaldehyde treatment, see Farmers' Bulletin 507.[1]

The germination of wheat, oats, and barley is usually good. Rye quickly loses its germinating power, and seed of this grain more than a year old should not be used unless a test shows that it will germinate. Germination tests may be made at home, or samples may be sent for this purpose to the Seed Laboratory of the appropriate State experiment station or of the United States Department of Agriculture.

SOWING THE SEED.

TIME OF SOWING.

Winter grains should be sown early enough to allow the plants to become well started before continued freezing weather begins. However, they should not be sown so early as to allow them to start jointing in the fall. In those sections in which the Hessian fly is troublesome, the sowing of wheat should be delayed until about the time the Hessian fly ceases to lay eggs. If the young wheat plants come up before that time, eggs are deposited on them and the crop later is injured by the insects which develop from these eggs. In Frederick County, Md. (altitude about 600 to 1,000 feet), wheat sown after October 1 usually escapes injury from this pest. Farther south later seeding is necessary. Seeding should be delayed one day from October 1 for each 12 to 15 miles of distance south of Frederick County. There should also be a delay of one day for each decrease of 100 feet in altitude. Thus, in the Coastal Plain section of Delaware, where the altitude is 500 to 800 feet lower, seeding should be about one week later than in Frederick County, or about October 8. In the Coastal Plain section of southern Virginia, which is 125 to 175 miles farther south, there should be an additional delay of 10 to 15 days, making October 20 the safe date for seeding to escape Hessian-fly injury. The dates above mentioned are subject to considerable variation as a result of weather conditions. Excessive dampness tends to hasten the emergence period of the fly, while drought delays it. In no case should seeding be delayed so long that the plants do not make sufficient growth to withstand the winter. If sown on well-prepared soil at the dates

[1] Johnson, E. C. The smuts of wheat, oats, barley, and corn. U. S. Dept. Agr., Farmers' Bul. 507, 32 p., 11 fig. 1912.

here recommended, there will be little danger of loss from winter injury.

Winter rye may be sown with safety from one to two weeks later than wheat. However, earlier seeding of rye than is ordinarily practiced is recommended. In a varietal test of winter rye at the Arlington Farm, an experiment farm of the Department of Agriculture near Washington, D. C., excellent results have been obtained for several years by sowing this crop at the same time as wheat.

Winter oats should be sown a week to ten days earlier than wheat. For eastern and southern Maryland and eastern Virginia the best time for sowing is during the last two weeks of September and the first week of October. In West Virginia and in western and northern Maryland winter oats should be sown not later than September 10. In the mountain section of Virginia oats may be sown from September 1 to 20. Winter barley should be sown at about the same time as winter oats. In the Piedmont and mountain sections, winter barley should be sown about a week earlier than wheat.

METHOD OF SOWING.

In experiments in which drilling and broadcasting winter grains have been compared, better yields have usually been obtained from drilling. A more economical and uniform distribution of the seed, a higher percentage of germination, and a more even stand are among the chief advantages of drilling.

On a well-prepared seed bed containing plenty of moisture, from 1 to 1½ inches is a sufficient depth to sow winter grains. In dry seasons the depth should be increased to 2 or 3 inches, because the seed must reach moist soil to insure quick germination.

The drills commonly used in this section are equipped with various furrow-opening devices, which place the grain in rows 7 or 8 inches apart. The hoe, shoe, and disk drills all do good work on a well-prepared seed bed free from trash. For sowing on disked corn-stubble land or where there is other trash, the disk drill, preferably the single-disk type, is superior. The hoe and single-disk drills place the grain in a much more distinct furrow than either the shoe or double-disk drill. This is an advantage, as the ridges protect the plants from cold winds and also collect and hold snow. For this reason also drag chains, press wheels, and other leveling devices are not ordinarily used in drilling winter grains in this section.

RATE OF SEEDING.

On medium to fertile soils winter wheat should be sown at the rate of 6 pecks per acre. On highly productive soils 4 to 5 pecks are sufficient in a well-prepared seed bed. In a rate-of-seeding experiment conducted on the Arlington Farm for four years, as high yields of

wheat have been obtained from seeding at the rates of 3 and 4 pecks per acre as from 6 and 7 pecks. It is not yet known how widely these results may be applied.

Winter rye should be sown at the rate of 6 pecks per acre. On very productive soils 4 to 5 pecks is a sufficient quantity of seed to sow.

Winter spelt should be sown at the rate of 3 to 4 bushels (90 to 120 pounds) per acre. As the kernels do not thrash free from the glumes (chaff or hulls) the grain is rather bulky. For this reason it is necessary to sow a large quantity of seed per acre.

Winter oats should be sown at the rate of 6 to 8 pecks per acre for all varieties other than those of the Red Rustproof group. These oats have large kernels with tufts of hairs at the base and with beards which do not break off in thrashing. Because of these characteristics the kernels do not pack together like those of other varieties, and they do not feed freely through the drill. For this reason 10 to 12 pecks of Red Rustproof oats should be sown to the acre.

Winter barley should be sown at the rate of 8 to 10 pecks per acre, preferably the former.

While these rates for the several classes of small grains are generally applicable in the section here discussed, allowances should always be made for poor germination, inferior quality of seed, a poorly prepared seed bed, lateness of seeding, and unproductive soil, and the rate of seeding should be increased accordingly.

HARVESTING.

WHEN TO CUT.

The small grains should be cut at the time when the largest yield of the best quality can be obtained. Wheat and other grains are ready to cut when only a slight tinge of greenness remains in the straw. The hardness of the kernel is also an indication of maturity, the grain being ready to cut when it is passing out of the hard-dough stage.

As the acreage of grain on most farms in this section is comparatively small, wheat and rye usually may be allowed to stand until fully ripe. If wheat is allowed to become overripe the bundles made by the self-binder are hard to shock. The loss by shattering in allowing oats and barley to stand after they have passed the hard-dough stage will be greater than the increase in yield of the crop through increase in weight.

SHOCKING.

Small grain should be shocked carefully in this section. The importance of good work in setting up a shock of grain is often not fully realized. When the work is not well done, a great number of

shocks often go down or the caps blow off, causing damage to the grain and loss of the time necessary for resetting or recapping the shocks.

The chief objects in shocking grain are to allow it to cure properly and to protect it from sunshine as well as from dampness. The protection from sunshine is of more importance than is sometimes realized. The effect of sunshine is to bleach the grain and injure its quality.

The following method of shocking is convenient and satisfactory. The shock built by this method protects the grain and also stands up well. First, set up two bundles, flat sides together. Most binders make bundles which are not round, but somewhat flattened. These bundles should be set down with the butts slightly apart, squarely and firmly, so that they will stand alone under ordinary conditions. Next, set another bundle at each end of this pair, so that there will be four in a row. Then set one in the middle of each side. This will leave a space at each of the four corners, in which a bundle should be placed. There are now 10 bundles in the shock, which is about the proper number ordinarily. If the grain is very dry or overripe a few more bundles may be set around the shock where they seem to fit best. In making this kind of shock in windy weather it is better to set the third and fourth bundles at the sides instead of at the ends as just described. The end bundles may then be added and the shock completed as before. The result is the same in either case, but the latter method is easier when the wind is strong enough to interfere with the work.

When the required number of bundles is set up, the shock should be capped. There is some difference of opinion as to whether one or two bundles should be used for capping. One cap allows more circulation of air through the shock, so that the grain dries out more quickly if the shock becomes wet. Less labor is required also, as only one bundle has to be broken. The chief advantage in using two caps is the greater protection afforded, as the grain does not get wet so readily.

A bundle to be used for a cap is broken by supporting it with the butts on the knees and with one forearm and hand under it at the band, while the straw is broken over just above the band with the other hand. If one cap is used the grain end always should be placed in the direction of the prevailing winds. If two are used the second cap should be placed similarly and at right angles to the first. By devoting some attention to this detail very few caps will be blown off under ordinary weather conditions.

STACKING.

In Delaware, Maryland, and the Virginias, grain is often stored in barns from the time it is cured in the shock till it is thrashed. This

is the most satisfactory method of handling the crop from a small acreage. If, however, there is not sufficient storage space, it should be stacked. In stacking, build a temporary base of fence rails or other light timbers to keep the stack from coming in contact with the ground and absorbing moisture from it. Usually two layers of timbers, the second placed at right angles to the first, will make a satisfactory foundation. The size of the foundation, of course, varies with the size of the stack which is to be built.

Begin at the center and complete each layer with the outside row (course) of bundles before beginning another layer. The heads of each bundle should point toward the center of the stack. Gradually increase the diameter of the stack with each layer until the proper bulge is formed. Then decrease the diameter by drawing in the outside row of each layer slightly, in order to build the top of the stack properly. This is simply the reverse of the process of making the bulge.

The most important point to keep in mind in building a stack that will shed water is to keep the middle full, well tramped, and a little higher than the rim. If a few bundles slide off in the progress of the stacking it is much better than to have the stack take water when settled.

The top of the stack may be prevented from blowing off by tying the ends of two light timbers together with wire or rope and hanging them across it. More than one of these binders may be used if necessary. Where a stack is allowed to stand for several months it is usually advisable to cover it with canvas, straw, coarse hay, or some other material, to protect the top of the stack.

THRASHING.

The thrashing of any small-grain crop should never be attempted when it is damp or when it is passing through the sweat. It will not only be difficult to thrash—the straw wrapping around the cylinder and the shafts of the separator—but all the grain may not be removed from the straw. If grain is thrashed when damp there is danger that it will heat and spoil in the bin. If the farmer wishes to keep his variety as pure as possible, it is advisable to keep the first 25 to 50 bushels thrashed separate from the remainder of his crop, for by so doing the danger of mixing the variety grown on his neighbor's farm with that on his own is reduced to a minimum. When the bulk of the crop is not to be utilized for seed, enough grain for sowing on one's own farm and for sale to any neighbors who may want to buy or exchange seed may be set aside when the crop is about half thrashed.

VARIETIES TO GROW.

The best measure of the value of any variety of wheat or other small grain is its yield in bushels per acre in comparison with other

and similar varieties. No other quality is so important as the ability of a variety to produce a high average yield. Varietal experiments with the various fall-sown grains have been conducted by the Office of Cereal Investigations of the United States Department of Agriculture at Arlington Farm, near Washington, D. C., and in cooperation with the Maryland Agricultural Experiment Station at College Park, Md.[1] The methods used in growing the varieties in these tests were as similar as possible to those used in good farm practice in the sections of Maryland and Virginia to which the results are believed to be applicable. Every effort was made to secure uniform conditions, so as not to give one variety or group of varieties any undue advantages over others. These tests have been conducted for five to eight years.

Varietal experiments with winter grains have also been conducted by the State agricultural experiment stations at Newark, Del., Blacksburg, Va., and Morgantown, W. Va. None of these stations has issued bulletins recently on the results of their experiments with these crops, but the recommendations here made are based on recent correspondence with the agronomists who are conducting the tests.[2]

WINTER WHEAT.

Varieties of winter wheat have been tested for eight years at College Park (Md.) and for seven years at Arlington Farm (Va.). During this period the leading red wheats at College Park have been China and Currell, beardless varieties with smooth brown chaff, and Mammoth Red, Bearded Purple Straw, Turkish Amber, Fulcaster, and Dietz, all bearded wheats with smooth white chaff. Bearded Winter Fife, a white wheat with bearded heads and hairy white chaff, has also yielded well. The leading varieties of red wheat at Arlington Farm have been Purple Straw and Fultz, beardless with smooth white chaff; Poole, beardless with smooth brown chaff; and Fulcaster, bearded with smooth white chaff. Of the white wheats, Dawson has yielded best. The average yields of these varieties at College Park and Arlington Farm for the periods mentioned range from 29 to 32 bushels. Heads of several of these varieties are shown in figure 1.

For Delaware, the bearded varieties recommended are Rudy, Red Wonder, Gipsy, and Stoner (Miracle). The best beardless varieties are Leap, Poole, and Currell. In general, the bearded varieties have given better results than the beardless ones. At the Virginia Agricultural Experiment Station, Fulcaster, Stoner (Miracle), and Medi-

[1] For full details of these tests, see Stanton, T. R., Cereal experiments in Maryland and Virginia. U. S. Dept. Agr. Bul. 336, 51 p., 6 fig. 1916.

[2] The data on varietal experiments at their respective stations have been supplied by Messrs. A. E. Grantham, T. B. Hutcheson, and I. S. Cook, jr., agronomists of the Delaware, Virginia, and West Virginia agricultural experiment stations, respectively.

terranean are the leading bearded varieties, with Leap and Fultz among the best beardless ones. At the West Virginia station, Poole, Currell, Fulcaster, Fultz, and Dawson are recommended.

These experiments show that numerous varieties do well in the section under discussion. Many of these, however, are very similar, and often several names are used for what is really only one variety. Among the varieties which can be most strongly recommended are the following:

For the Coastal Plain.—Bearded varieties: Fulcaster, Gipsy, Red Wonder, Rudy, and Stoner (Miracle). Beardless varieties: China, Currell (Currell Prolific), Fultz, Leap (Leap Prolific), and Poole.

FIG 1.—Heads of six varieties of winter wheat grown at the Maryland Agricultural Experiment Station and at Arlington Farm: 1, Dietz (Dietz Longberry); 2, Missouri Bluestem; 3, Purple Straw; 4, China; 5, Bearded Winter Fife; 6, Dawson Golden Chaff.

For the Piedmont area.—Bearded varieties: Bearded Purple Straw, Dietz, Fulcaster, and Mammoth Red. Beardless varieties: China, Currell (Currell Prolific), Dawson (Dawson Golden Chaff), Fultz, Poole, and Purple Straw.

For the mountain section.—Bearded varieties: Fulcaster, Gipsy, and Rudy. Beardless varieties: Currell (Currell Prolific), Dawson (Dawson Golden Chaff), Fultz, Harvest King, and Poole.

Of the above all are red wheats except Dawson (Dawson Golden Chaff), a white-kerneled variety. This white wheat yields well, but is not as good for flour as the red wheats.

WINTER SPELT AND EMMER.

Varieties of spelt and emmer have been tested for seven years at College Park and for six years at Arlington Farm. These grains are closely related to wheat, but they do not thrash free from the hull.

They are used as feed for domestic animals and are quite similar to oats in feeding value. At College Park the Alstroum and Red Awnless varieties of spelt have given 6-year average yields of 73 and 70 bushels of 30 pounds each, respectively, while at Arlington Farm they have made 6-year averages of 75 and 73 bushels, respectively. Both are beardless varieties. The Alstroum has white glumes (chaff), and the Red Awnless has red chaff. Black Winter emmer has produced very low yields as compared with spelt. It has produced 6-year average yields of 37 and 23 bushels of 30 pounds each at College

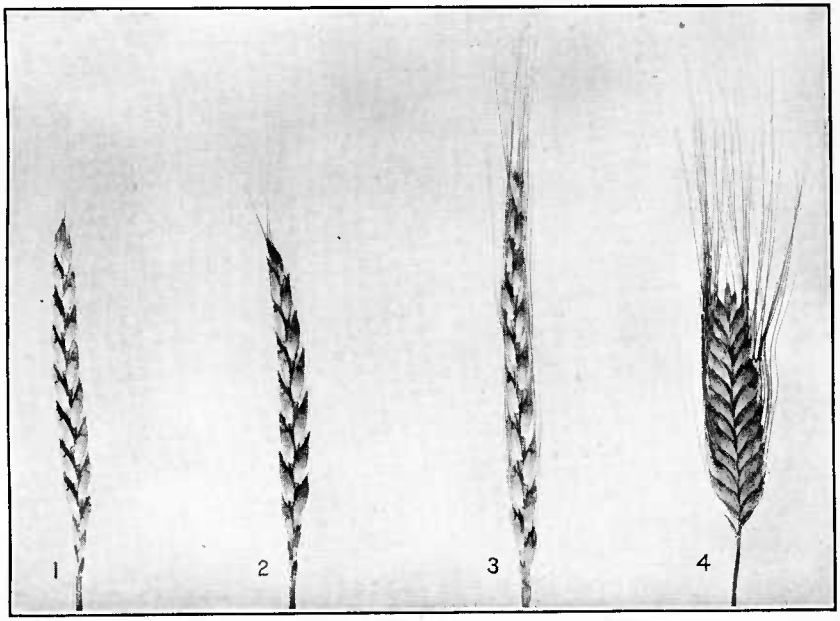

FIG. 2.—Heads of three varieties of spelt and one variety of emmer grown at the Maryland Agricultural Experiment Station and at Arlington Farm: 1, Alstroum spelt; 2, Red Awnless spelt; 3, Servia spelt; 4, Black Winter emmer.

Park and Arlington Farm, respectively. The Alstroum and Red Awnless spelts are recommended for growing for feed in place of oats and barley, as they yield more grain than either of these crops. Heads of spelt and emmer are shown in figure 2.

WINTER RYE.

Varieties of winter rye have been tested at the Arlington Farm for five years. Practically all the varieties tested have yielded well. The leading ones are Giant Winter, Abruzzes, and Virginia Winter, with average yields for the period tested of 37, 36, and 35 bushels, respectively. These are tall, vigorous-growing, large-strawed varie-

ties, producing large brownish yellow kernels. Heads of these varieties are shown in figure 3. The varieties of rye which have proved most satisfactory at the Virginia station are Thousandfold, Abruzzes, and Virginia Winter. No varieties are especially recommended for Delaware and West Virginia. It is sometimes difficult to obtain named varieties of rye on the market in this section, "winter" rye being commonly sold. This is usually the rye here recorded as Virginia Winter. The differences in yield and appearance among most of the more common varieties of rye are not great, and in this section any good winter rye should give satisfactory results.

FIG. 3.—Heads of four varieties of winter rye grown at Arlington Farm: 1, Giant Winter; 2, Virginia Winter; 3, Abruzzes; 4, Henry.

WINTER OATS.

Varieties of winter oats have been tested for eight years at College Park and for five years at Arlington Farm. For this period the leading variety at College Park has been Winter Turf (Virginia Gray), a late-maturing oat. Culberson, a medium-early variety, has also yielded well. At Arlington Farm, Winter Turf has been the leading variety. Other varieties that have yielded well at Arlington Farm are Culberson and Red Rustproof, an early large red oat. At College Park, Culberson and the best strain of Winter Turf have made average yields for seven years of 46 and 51 bushels, respectively. At Arlington Farm the best strains of Culberson, Red Rustproof, and Winter Turf have given 5-year average yields

of 43, 43, and 47 bushels, respectively. At the Virginia Agricultural Experiment Station Winter Turf and Culberson are best.

The Winter Turf oat is hardier than the Red Rustproof and Culberson and is specially recommended for the Piedmont and mountain sections and for Delaware. In the Coastal Plain sections of Maryland and Virginia, the Red Rustproof and Culberson are to be preferred because of their earlier maturity. Heads of these varieties are shown in figure 4.

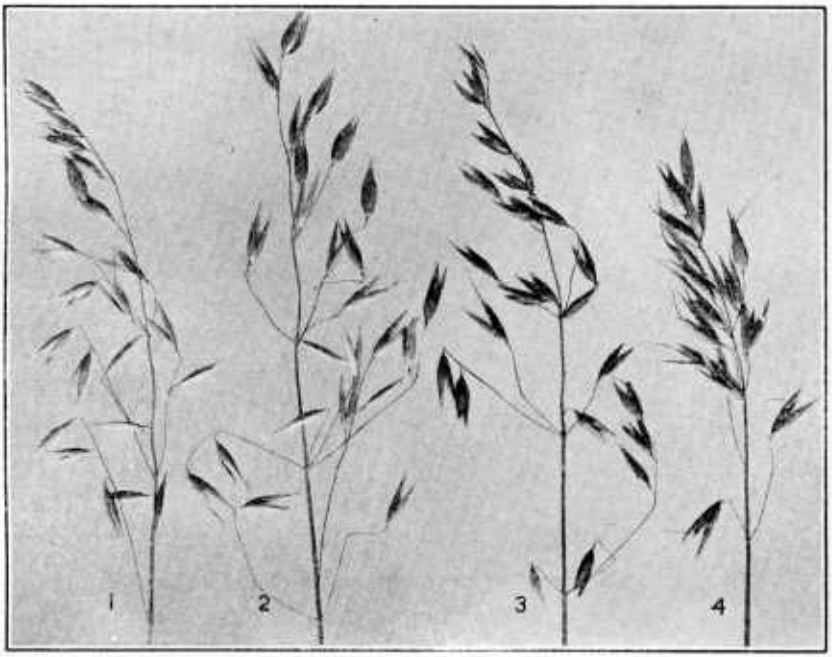

FIG. 4.—Heads of four varieties of winter oats grown at the Maryland Agricultural Experiment Station and at Arlington Farm: 1, Culberson; 2, Bicknell; 3, Winter Turf; 4, Red Rustproof.

In West Virginia, in the mountain sections of Maryland and Virginia, and in Delaware winter oats often winterkill. When they survive the winter, however, they yield much better than spring oats. The best insurance against winterkilling is early sowing. If the Winter Turf (Virginia Gray) is sown early in these sections (not later than September 15 to 20), winterkilling will be experienced only during the most severe winters. Only a very small proportion of the oat crop of West Virginia and western Maryland is sown in the fall.

WINTER BARLEY.

Varieties of winter barley have been tested for eight years at College Park and for seven years at Arlington Farm. For this period

the leading variety at both places has been the Tennessee Winter, a bearded, 6-rowed form. The average yields of this variety for seven years at College Park and Arlington have been 34 and 29 bushels, respectively. Varieties known as Maryland Winter and Union Winter are practically identical with the Tennessee Winter. Of the varieties of winter barley that have been tried by the Virginia Agricultural Experiment Station, Tennessee Winter and Union Winter seem best adapted. Heads of winter barley are shown in figure 5.

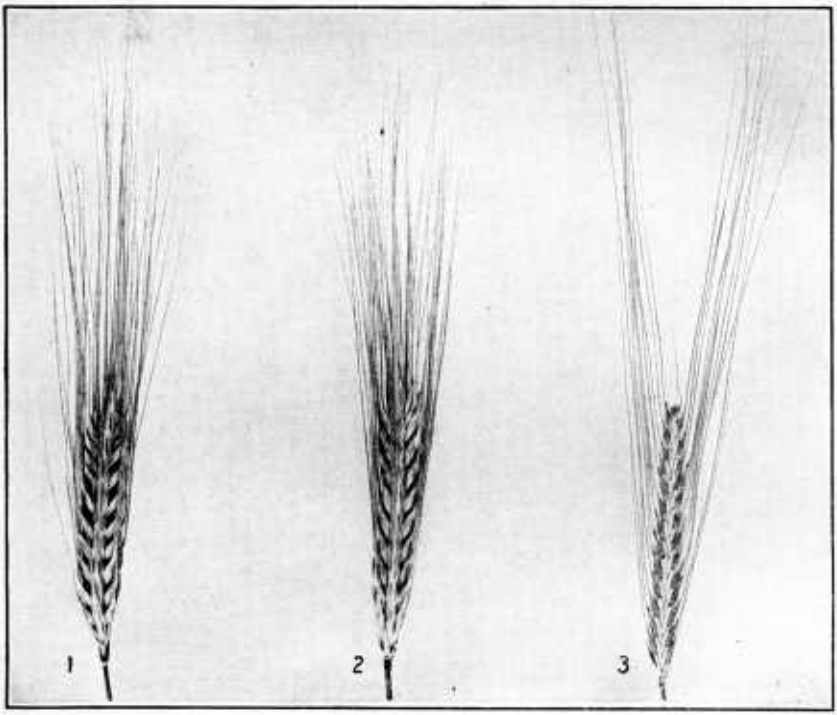

FIG. 5.—Heads of three varieties of winter barley grown at Arlington Farm: 1, Tennessee Winter; 2, Wisconsin Winter; 3, Omar.

Winter barley is hardier than winter oats and can be grown successfully anywhere in Delaware, Maryland, and the Virginias, except perhaps at the greatest elevations. Early seeding is necessary to insure success, however, in the mountain sections and in Delaware. The bearded varieties are hardier than the beardless (hooded) ones, and only the former should be grown. Hooded or beardless barley is often highly recommended in this section, particularly for hay and pasture, but it is not a safe crop to grow from fall seeding. Tennessee Winter and other similar bearded varieties make excellent fall and spring pasture, but they are somewhat objectionable for hay because of the long, stiff beards.

COMPARATIVE RETURNS.

The comparative returns from the various small-grain crops are of vital interest in determining which one to grow. As an indicator of the relative value of these crops in Delaware, Maryland, Virginia, and West Virginia, the average yield per acre of each crop in each State for the 10-year period from 1906 to 1915, inclusive, is presented in Table II. The yields are given both in bushels and in pounds. The acre value of each crop is also given. These values are figured on the average acre yields and average farm price per bushel in each State, as reported by the Bureau of Crop Estimates.

TABLE II.—*Average yields and farm values of wheat, rye, oats, and barley in Delaware, Maryland, Virginia, and West Virginia, for the 10-year period, 1906 to 1915, inclusive.*

State.	Yield per acre (bushels).				Yield per acre (pounds).				Value per acre.			
	Wheat.	Rye.	Oats.	Barley.	Wheat.	Rye.	Oats.	Barley.	Wheat.	Rye.	Oats.	Barley.
Delaware	16.7	15.2	29.5	.....	1,002	851	944	.....	$15.86	$8.51	$14.16	.....
Maryland	16.5	15.4	28.0	30.3	990	862	896	1,454	15.67	8.62	13.44	$18.79
Virginia	12.6	13.0	20.2	27.2	756	728	646	1,306	12.60	7.28	10.50	19.04
West Virginia	13.2	13.0	22.9	.....	792	728	733	.....	13.46	7.28	11.68	.....

As shown in Table II, wheat ranks highest in pounds of grain produced and in acre value of the crop in Delaware and in West Virginia. In Maryland and Virginia it is considerably exceeded in both respects by barley, a crop which is grown on only a small acreage and is not reported at all for the other two States. Oats rank next to wheat in value in every State, rye being lowest in every case. The acre yield of rye in Virginia is higher than that of oats, but is lower in the other States.

The figures for oats and barley in Table II are not entirely comparable with those for wheat and rye, for no separation is made by the Bureau of Crop Estimates of the spring-sown and fall-sown crops. The wheat and rye in these States are practically all fall sown, while much of the oats and some of the barley are spring sown, particularly in Maryland and West Virginia.

A more reliable basis of comparison for the various crops in the Piedmont and Coastal Plain sections is afforded by the average yields obtained at Arlington Farm, Va., and at College Park, Md. Yields and values of the highest yielding varieties of each crop are shown in Table III. The yields at each place are all for the same period of years and all the grains were grown under very similar conditions. All were sown in the fall.

TABLE III.—*Average acre yields and acre values of the highest yielding varieties of the various fall-sown grains at Arlington Farm, Va., and at College Park, Md., for stated years.*

Place, period, and crop.	Yield per acre.		Value per acre.
	Bushels.	Pounds.	
Arlington Farm, 5-year period, 1911 to 1915, inclusive:			
Purple Straw wheat	33.45	2,007	$34.11
Alstroum spelt	68.88	2,066	.....
Giant Winter rye	34.25	1,918	29.99
Winter Turf oats	47.53	1,521	26.14
Tennessee Winter barley	27.57	1,323	20.61
College Park, 6-year period, 1909 to 1914, inclusive:			
Bearded Purple Straw wheat	30.62	1,837	29.62
Alstroum spelt	63.23	1,897	.....
Winter Turf oats	49.30	1,578	23.78
Mammoth Winter barley	34.99	1,679	22.81

According to Table III, the highest yield of grain in pounds at each place was produced by Alstroum spelt. As this grain is not commonly grown, however, and is not readily marketable, it is not possible to compare it with the other crops in acre value. Because of its high yield it should be a valuable grain to grow on farms where it can be fed to live stock. At Arlington Farm, rye has yielded only slightly less than wheat and ranks next to it in acre value. This crop was not included in the tests at College Park. Oats and barley rank considerably below wheat in both yield and value, oats exceeding barley in value at both farms.

According to the figures here presented, wheat is the most profitable of the fall-sown grain crops in this section, rye, oats, and barley following in order. The high yields obtained from rye at Arlington Farm are evidence of the ability of that crop to yield profitable returns when sown reasonably early on fertile, well-prepared land. The low yields of rye commonly obtained are due to the fact that the crop is usually sown very late and on poor soil.

The yields of the various crops on the two experiment farms are double or more than double the average yields in Maryland and Virginia, as reported by the Bureau of Crop Estimates. This is an indication that the average yields can be materially increased if only the best varieties are grown and proper attention is given to the preparation of the land, its fertility, and the time and rate of seeding.

SUMMARY.

The essentials for the profitable production of fall-sown grains in Delaware, Maryland, and the Virginias may be summarized briefly as follows: A well-drained soil; proper fertilization; a good system of crop rotation; a well-prepared seed bed; good, pure, cleaned, and graded seed which has been treated for smut; seeding at the proper

time and rate; and growing adapted, high-yielding varieties. The best varieties for these States are the following:

WHEAT.

Bearded varieties:
- Dietz.
- Fulcaster.
- Gipsy.
- Rudy.
- Stoner.

Beardless varieties:
- China.
- Currell (Currell Prolific).
- Fultz.
- Leap (Leap Prolific).
- Poole.
- Purple Straw.
- Dawson (Dawson Golden Chaff).

RYE.

- Abruzzes.
- Giant Winter.
- Virginia Winter.

SPELT.

- Alstroum.
- Red Awnless.

OATS.

- Culberson.
- Red Rustproof.
- Winter Turf.

BARLEY.

- Tennessee Winter.
- Union Winter.

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